Meyer Burger:

Delivering innovative PV tech

Major Swiss photovoltaics supplier Meyer Burger is showcasing new Heterojunction and SmartWire Connection technologies that can boost PV efficiencies to greater heights. Mark Andrews found out more on a recent visit to SEMICON West.

Left: Heterojunction cells.
Image courtesy Meyer Burger

ANY TECHNOLOGY delivering better performance wins marketplace attention. Whether the total package can shake-up solar markets is in the details: the place this story begins.

Swiss photovoltaics supplier Meyer Burger is an established industry leader. Their precise, reliable and innovative approaches to core technologies have enabled the company's many customers to achieve success through advanced wafer processing and manufacturing techniques. Meyer Burger is known for its innovative manufacturing processes for wafers, solar cells, solar modules and solar systems as well as expertise that extends to enhanced coating technologies and other synergistic programs.

While Meyer Burger continues to deliver highly competitive wafer processing solutions the company is looking for future growth through their new high performance Heterojunction (HJT) cell architecture. While core HJT principles were first commercialized by Sanyo and Panasonic, Meyer Burger is taking a new approach worth examining.

Important benefits of the company's Heterojunction technology emerge by seeing how it compares utilizing levelized cost of electricity (LCOE) values. As the name implies, calculating LCOE 'levelizes' factors influencing a cell's performance including the operational environment, balance of system (BOS) costs, maintenance and many other variables that tend to fall into either local- or system-level parameters.

LCOE calculations reveal a strong efficiency benefit. Meyer Burger's Heterojunction performance is superior to standard mono and mc-Si cells by at least 2 full points. Temperature coefficient is also dramatically lower: >-0.25 percent/°C compared to -0.43 percent/°C (or greater) from competing technologies. Another standout is module lifetime: 40 years for modules with Heterojunction cells and 25 for others, which is also borne out in degradation figures – just 0.1 percent for Heterojunction and 0.35 percent for the other technologies.

Despite the impressive gains that LCOE figures demonstrate, Heterojunction innovation isn't the whole story. Meyer Burger is also changing the basics of how PV cells collect energy.
Busbars have long been a mainstay for collecting electricity from solar radiation. Three to five bars and

Cell conection station for SmartWire Connection Technology. Image courtesy Meyer Burger

heavy silver fingers collect electrical energy in many gigawatts of installed global solar power capacity. Meyer Burger developed a new way to eliminate the busbar, an approach it calls SmartWire Connection Technology (SWCT).

The fine details in this case are more than 2,600 individual fingers and strands that eliminate heavy busbars, resulting in PV cells that are measurably more efficient while being less prone to breakage. Combine the efficiency of Heterojunction technology with SmartWire Connection Technology and it is clear to see that a new approach to PV cell performance has been achieved.

Elegance in the details

Global PV cell manufacturers depend upon suppliers' technology and their own innovation. Despite the dynamic nature of solar manufacturing, new ideas are generally not rushed into production due to the stakes and costs involved. Meyer Burger spent years developing and improving its Heterojunction technology in partnership with the PV Center of the Swiss Center for Electronics and Microtechnology (CSEM), and its own Meyer Burger Research SA.

In close cooperation with its research partner, Meyer Burger began research in 2008 and has achieved record setting levels of module performance with its innovative high efficiency Heterojunction cell technology.

Heterojunction technology differs from other silicon-based PV cell architectures by placing nanometer thick layers of amorphous silicon onto both sides of mono crystalline silicon wafers using PECVD techniques. HJT efficiency is higher than standard cells' efficiency – Meyer Burger HJT cells start at 22 percent average cell efficiency. The HJT process is also more economical in that it requires fewer steps and smaller quantities of expensive materials. Heterojunction combines the advantages of crystalline silicon solar cells with the absorption and passivation characteristics of amorphous silicon used in thin film technology. The excellent surface passivation of the a-Si:H layers results in efficiencies that exceed many other products – 327 Watts in a standard 60-cell module.

	Standard mc-Si	Standard mono	Heterojunction
Module efficiency	15.6 percent	17.2 percent	19.2 percent
Temperature coefficient	–0.46 percent/K	–0.43 percent/K	–0.2 percent/K
Cell cost per piece	$1.67	$2.19	$2.19
Module manufacturing costs	$45/m²	$45/m²	$45/m²
60-cell module price	$172	$203	$203
Module lifetime in years	25	25	40
Area-related BOS costs	$62/m²	$62/m²	$62/m²
Power-related BOS costs	$260/kW	$260/kW	$260/kW
PID+LID 1st year	3 percent	3 percent	0 percent
Long-term degradation	0.35 percent/yr	0.35 percent/yr	0.1 percent
O&M costs per year	2 percent of CAPEX	2 percent of CAPEX	2 percent of CAPEX
PR (excluding temp. effect)	0.9	0.9	0.9
Discount rate (WACC)	4 percent	4 percent	4 percent
Additional assumptions for cash flow calculations			
Interest rate	4 percent	4 percent	4 percent
Inflation rate	2 percent	2 percent	2 percent
Energy value (discounted to year 0)	$0.15/kWh	$0.15/kWh	$0.15/kWh

Credit: Courtesy Meyer Burger, data source 2014

Finer lines / better performance

While developing their core Heterojunction process, Meyer Burger also looked at ways to change the way PC cells collect energy. Busbars have been and remain a standard collection architecture used in many cell types. But heavy silver busbars and soldered connection points that have proven fragile over time prodded R&D initiatives to conserve silver, cut costs and improve electricity collection.

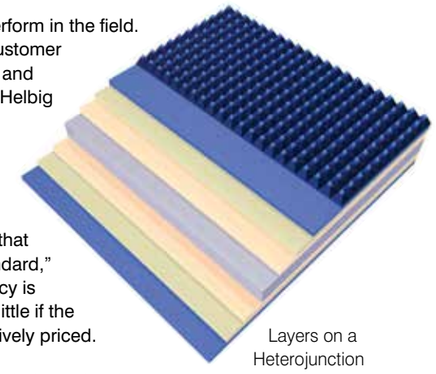
In comparison to conventional busbar cell design approaches, Meyer Burger's SmartWire Connection Technology (SWCT) uses less silver. How much less? Less than 2.4gr of silver per 60 cell module, and in the process Meyer Burger's approach (SWCT + HJT) can boost energy collection up to 5.7 percent compared to a 3 busbar cell.

In SWCT, making channel current connections is accomplished when silicon layers are encapsulated by lamination. SWCT utilizes a dense contact matrix of up to 2,660 points on each cell compared to the 165 contacts in a typical three busbar cell. While heavy busbars and thicker conventional silver 'fingers' need to be fired and soldered at high temperature, thinner SWCT fingers adhere through lower temperature processes, again saving materials and energy. SWCT fingers are electrically connected in a close grid, creating superior contact adhesion which helps prevent micro-cracks and cell breaks. Heterojunction cells using SmartWire are also less susceptible to transportation and installation damage. These cells don't require the heavy metal support framing associated with traditional solar panel modules, which again reduces cost and prolongs the lifetime of PV cells and modules.

Saving silver and other materials means saving money. Meyer Burger's approach can reduce silver consumption to <2.4gr per 60 cell module. As a further bonus, SmartWire Connection technology is compatible with all silicon PV cell technologies including next-generation finger metallization techniques, and of course, Meyer Burger's own Heterojunction architecture.

In the field / on the roof

While comparative product analyses demonstrates real performance advantages when Heterojunction architecture is paired with SWCT energy collection technology, the ultimate test is how these new technologies perform in the field. Meyer Burger's Head of Customer Relations, Thomas Hengst and Product Manager Thomas Helbig are on the front lines.



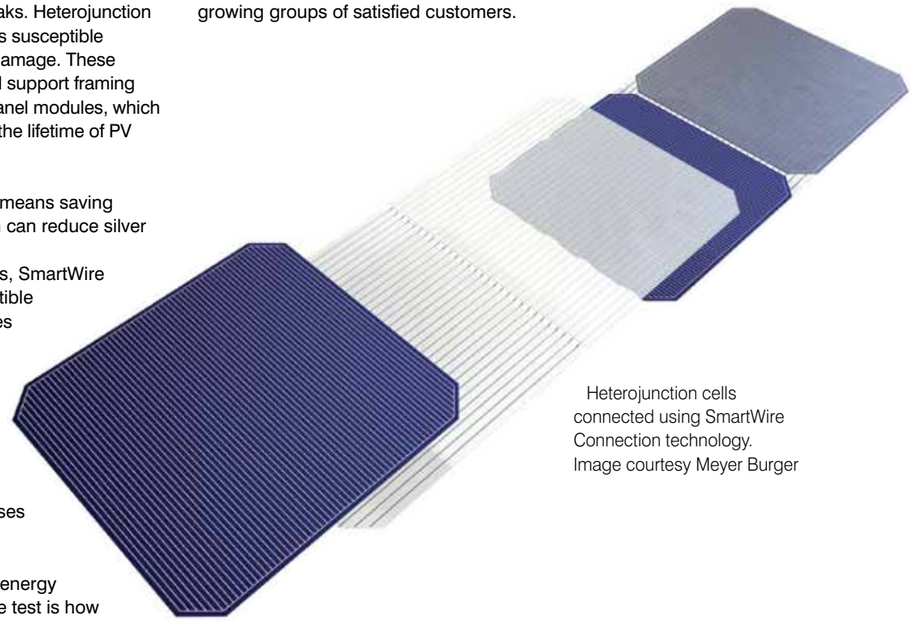
Layers on a Heterojunction cell. Image courtesy Meyer Burger

"Our approach from the beginning was to make the new technologies competitive and at a price that can be a new industry standard," said Hengst. "High efficiency is important, but that means little if the technology is not competitively priced.

Most company's talk about their product in terms of very large scales that are not meaningful in residential or small commercial applications. Meyer Burger's technology definitely competes at all levels and is also appealing in larger projects."

Another area that differentiates Meyer Burger's approach is in-field testing. According to Hengst the efficiency figures the company offers have been proven outside tightly controlled laboratory settings; making sure manufacturable product performance is comparable to R&D results – it's a hallmark of their overall programs.

Like Hengst, Thomas Helbig has been with Meyer Burger for a lengthy tenure. Both have seen Heterojunction and SmartWire Connection technologies mature to the point that competitiveness and performance are winning over customers. Hengst and Helbig believe this will translate into growing groups of satisfied customers.



Heterojunction cells connected using SmartWire Connection technology. Image courtesy Meyer Burger

> Meyer Burger is again demonstrating that evolving core technologies and creating new PV processes will drive successful solar power development. With Heterojunction cell architecture and SmartWire Connection Technology, the choices of how to generate electricity from the sun keep getting better and better.

"Balance of system costs account for around 50 percent of total PV installation expense. Thanks to significantly higher efficiencies with HJT/SWCT modules, the BOS advantage is about 11 percent," noted Helbig. "The durability and reliability of SmartWire Connection technology offers the best protection against environmental influences.

Our tests have shown a lifespan of more than 40 years, which is far superior to other cell types. It's a new technology, a new approach, so we understand the public will need to learn about its benefits. But the more they know, the more they'll want Heterojunction and SmartWire. It will become one of the future standards for PV cells."

Made for the real world

Many technologies will play important roles as photovoltaic energy helps reshape the world's ability to cleanly and economically meet growing electricity requirements. Solar's contribution to reducing global warming is also well established.

Heterojunction and SmartWire Connection technologies are appealing thanks to their high efficiency, simplified production, robust performance and longer lifetimes.

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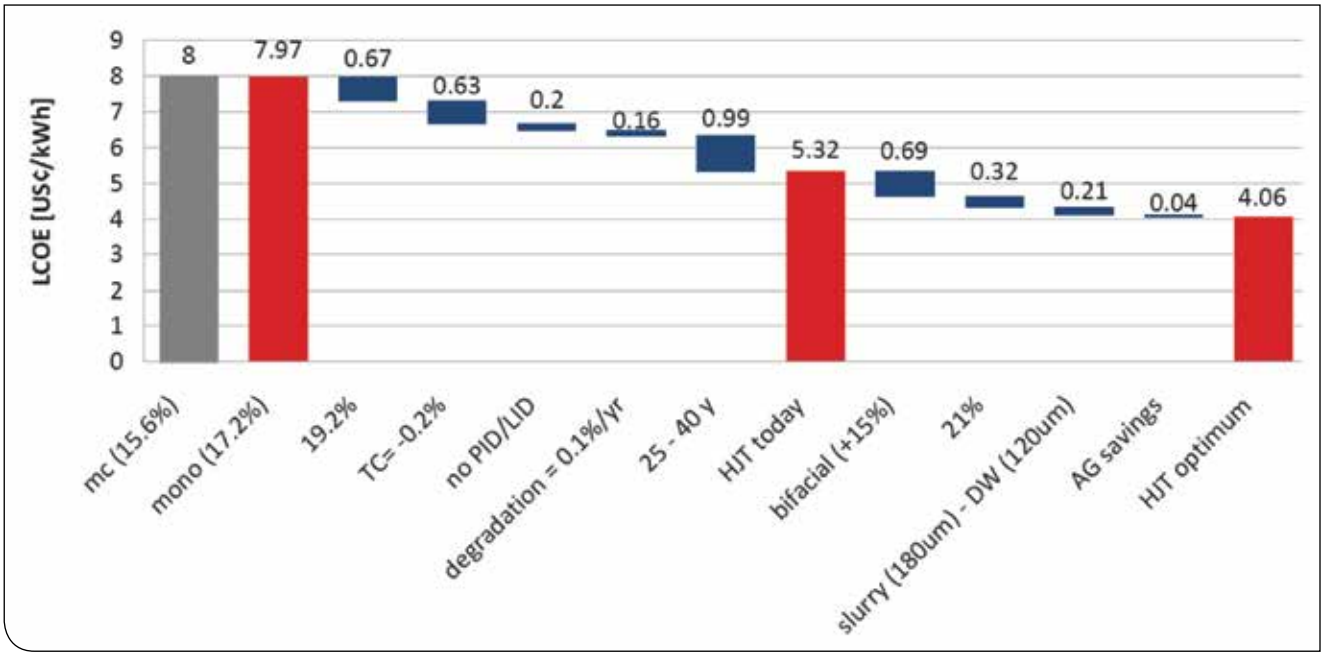

Credit: Courtesy Meyer Burger, data source 2014